



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : H04Q 7/22, 7/38, H04M 3/54	A1	(11) International Publication Number: WO 99/67961 (43) International Publication Date: 29 December 1999 (29.12.99)
(21) International Application Number: PCT/SE99/01127 (22) International Filing Date: 22 June 1999 (22.06.99) (30) Priority Data: 09/104,758 25 June 1998 (25.06.98) US (71) Applicant: TELEFONAKTIEBOLAGET LM ERICSSON (publ) [SE/SE]; S-126 25 Stockholm (SE). (72) Inventor: SÁNCHEZ HERRERO, Juan Antonio; Calle Francisco Salas, 31 1-C, E-28039 Madrid (ES). (74) Agent: ERICSSON RADIO SYSTEMS AB: Common Patent Dept., S-164 80 Stockholm (SE).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>
(54) Title: LOCATION TRIGGERED BARRING OF CALL FORWARDING (57) Abstract Call forwarding service provided to a wireless mobile communication station (MS _H) is controlled by barring call forwarding from the wireless mobile communication station selectively based on the location of the wireless mobile communication station (59, 67).		

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

LOCATION TRIGGERED BARRING OF CALL FORWARDING

FIELD OF THE INVENTION

5 The invention relates generally to wireless mobile communications and, more particularly, to improvements in call forwarding services provided to wireless mobile communication subscribers.

BACKGROUND OF THE INVENTION

10 In conventional wireless mobile communications, roaming agreements typically exist between network operators of respective public land mobile networks (PLMNs). Such roaming agreements permit a mobile subscriber unit based in a first PLMN to use the services and facilities of a second PLMN while the mobile subscriber unit is roaming in the coverage area of the second PLMN, outside the coverage area of the first PLMN.

15 Call forwarding (CF) is one example of a service that a roaming mobile subscriber might wish to use while roaming in the second PLMN. Using the conventional GSM (Global System for Mobile communications) network as an example of the first and second PLMNs, in a conventional GSM network the cost of forwarding (or otherwise deflecting) a call is charged to the mobile subscriber which invoked the forwarding. If the mobile subscriber is roaming internationally, then the forwarding of a call will very likely be charged, disadvantageously, as an international call. Paying international call charges to forward a call is typically very expensive.

20 Call deflecting service is similar to call forwarding, except the mobile subscriber interactively chooses (on a per call basis) to deflect the call to another destination rather than accept the call, whereas call forwarding services are typically handled in the serving mobile switching center (MSC) without interaction of the mobile subscriber. The problems and inventive solutions disclosed herein apply to both call forwarding and call deflecting services.

25 Another problem with forwarding the calls of the above-described roaming mobile subscriber is fraud. Call forwarding fraud during roaming occurs when the mobile subscriber uses call forwarding service to forward calls received while the

30

-2-

mobile subscriber is roaming internationally, but for which the roaming mobile subscriber does not intend to pay the corresponding international charges. Such fraud can be increased by maintaining several simultaneous calls after invocation of the call forwarding service. The same scenario can occur using call diversion service. This fraud problem is very costly for network operators due to the international signaling links and call legs involved during the calls. In fact, fraud is such a large scale problem that network operators in some countries refuse to provide services such as call forwarding services to mobile subscribers roaming in those countries.

In GSM, there are some conventional mechanisms for cost limitation when the mobile subscriber is roaming. For example, an operator determined bar (ODB) can be applied to outgoing calls originating at the mobile subscriber unit, including calls to be forwarded, such that the invocation of call forwarding services is barred. The ODB in GSM also provides for different restriction levels, for example, barring all calls, all international calls, all international calls except those directed to the mobile subscriber's home PLMN country, all inter-zone calls, or all inter-zone calls except those directed to the subscriber's home PLMN country. However, this solution will disadvantageously bar even outgoing calls for which the mobile subscriber consciously intends to pay the incurred cost.

Another possible solution to the above-described call forwarding problems is simply for the mobile subscriber to deactivate the call forwarding services. However, the subscriber may well forget to deactivate the services when roaming internationally. Moreover, deactivation of call forwarding does not address the fraud problem described above.

Call forwarding can be barred using conventional Regional Services functionality, but only by disadvantageously deregistering the mobile station from all services to which it subscribes whenever that mobile station enters the service area of a disallowed MSC. Moreover, this type of service must be implemented in the MSC/VLR and can only be used if the Regional Services functionality is implemented in the PLMN where the subscriber is roaming.

Another possible approach would be to use Intelligent Network (IN) architecture to implement services aimed at solving the above-described problems.

-3-

However, disadvantageously, the Intelligent Network support must be requested in the PLMN where the subscriber is roaming.

It is therefore desirable to provide to a roaming mobile subscriber call forwarding (or deflecting) service with automatically activated security against large, unwanted charges for forwarding/deflecting calls without barring all of the mobile subscriber's outgoing calls.

The present invention provides for selective barring of call forwarding/deflecting services. The selective barring is triggered by the location of the mobile subscriber unit, thereby avoiding the occurrence of many unwanted call forwarding/deflecting charges when the mobile subscriber unit is roaming, and all outgoing calls need not be barred.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 illustrates two inter-networked PLMNs including a call forward barring feature according to the invention.

FIGURE 2 illustrates an example of a memory and database in the HLR of FIGURE 1.

FIGURE 3 illustrates one example portion of the HLR of FIGURE 1 in greater detail.

FIGURE 4 illustrates an example portion of the MSC/VLR of FIGURE 1 in greater detail.

FIGURE 5 illustrates exemplary operations of the HLR portion of FIGURE 3.

FIGURE 6 illustrates exemplary operations of the HLR portion of FIGURE 8.

FIGURE 7 illustrates exemplary operations of the MSC/VLR portion of FIGURE 4.

FIGURE 8 illustrates another example portion of the HLR of FIGURE 1 according to another embodiment of the invention.

FIGURE 9 illustrates exemplary operations of the HLR portion of FIGURE 8.

DETAILED DESCRIPTION

FIGURE 1 illustrates an example of an inter-networking mobile communications arrangement that implements the present invention. In FIGURE 1, a mobile subscriber unit MS_H has roamed from the coverage area of its home PLMN,

-4-

designated in FIGURE 1 as HPLMN, into the coverage area of a visited PLMN, designated in FIGURE 1 as VPLMN. Conventional examples of the HPLMN and VPLMN of FIGURE 1 include GSM, DCS 1800 (Digital Cellular System for Mobile Communications), and PCS (Personal Communications System). The HPLMN and VPLMN of FIGURE 1 can be defined, for example, by any of the foregoing conventional network standards, such conventional networks of course being enhanced as disclosed herein to include the present invention.

Although only pertinent portions of HPLMN and VPLMN are illustrated in FIGURE 1 for clarity of exposition, it will be recognized that HPLMN and VPLMN of FIGURE 1 represent fully functional PLMNs. For example, the VPLMN includes a home location register HLR (or a suitable equivalent) similar to that shown in the HPLMN, and the HPLMN includes a mobile services switching center and visited location register (collectively designated as MSC/VLR in FIGURE 1) similar to that illustrated in the VPLMN. One example of an equivalent alternative to the MSC/VLR of FIGURE 1 is an SGSN (Serving GPRS Support Node). As mentioned above, with the exception of the herein described enhancements according to the present invention, the HPLMN and VPLMN of FIGURE 1 can be, and for purposes of this description are assumed to be, otherwise conventional.

Mobile subscriber MS_H is shown in broken lines in HPLMN to indicate that it has roamed out of HPLMN and into VPLMN where MS_H is shown to be visiting. Other mobile subscriber units MS are shown in both the HPLMN and the VPLMN. Although the present invention is described with respect to the mobile subscriber unit MS_H , the principles of the invention are equally applicable to any of the mobile subscriber units MS when they roam, for example, outside of their home PLMN.

When MS_H roams into VPLMN, it checks in with MSC/VLR (as is conventional), which requests a Location Update from the HLR of HPLMN using the MAP communications link illustrated diagrammatically at 12 in FIGURE 1. MAP refers to conventional Mobile Application Part signaling. This MAP "Location Update" operation is well-known in the art, and provides to HLR current location information regarding MS_H , along with other conventional information. In response to the MAP "Location Update" request, the HLR conventionally responds with a MAP "Insert Subscriber Data" message signaled, for example, over the MAP link 12.

-5-

According to the invention, the HLR also provides, in the "Insert Subscriber Data" message, information relative to call forwarding/deflecting services, for example, whether or not call forwarding services subscribed to by MS_H are to be barred. The MSC/VLR of VPLMN uses this bar information from HLR to decide whether or not to permit calls for MS_H to be forwarded (or deflected) to another destination, for example at 15, via a communications path 17. The destination 15 could also be located elsewhere, e.g. in another PLMN outside both PLMNs of FIGURE 1, or in a Public Switched Telephone Network (PSTN) as shown by broken lines.

FIGURE 2 illustrates one example of a memory 21 in the HLR of FIGURE 1. The memory 21 has stored therein a database 23 as shown. The database 23 includes information about operator determined barring (ODB) services to which various mobile subscribers have subscribed. Column 25 illustrates the mobile subscriber units (also referred to as mobile stations) MS1, MS2, etc. which have subscribed to ODB services. Column 27 illustrates the areas (designated A1, A2, etc. in which the subscribed ODBs are effective, and column 29 illustrates the calls which are barred (designated as Calls1, Calls2, etc.) when the respective mobile stations are located in the respective areas A1, A2, etc. of column 27.

Examples of the effective areas A1, A2, etc. in column 27 of FIGURE 2 include: outside of the mobile subscriber's HPLMN coverage area; outside of the mobile subscriber's HPLMN country; and outside of the mobile subscriber's HPLMN zone. Examples of the barred calls represented by Calls1, Calls2, etc. in column 29 of FIGURE 2 include: all forwarding calls; all international forwarding calls; all international forwarding calls except those directed to the subscriber's HPLMN country; all inter-zone forwarding calls; and all inter-zone forwarding calls except those directed to the subscriber's HPLMN country. These examples of effective areas and categories of forwarding (or deflecting) calls can be seen to yield, in this example, 15 distinct subscriptions available to the mobile subscribers. More specifically, for each of the aforementioned three effective areas, there are five different categories of calls which can be barred. Of course, the number and definition of effective ODB areas and the number and definition of barred calls categories can be set up as needed by the network operator in order to obtain the ODB functionality that is desired.

-6-

FIGURE 3 illustrates an example portion 31 of the HLR of FIGURE 1. The portion 31 may be used to implement the ODB services defined in FIGURE 2. In FIGURE 3, a detector 33 receives as inputs the location of the mobile subscriber and the effective bar area, and provides an output signal 35 indicative of whether or not the mobile subscriber is located in the corresponding bar area. For example, and referring also to FIGURE 2, the output signal 35 from the detector 33 would indicate whether or not the mobile station MS1 is within the bar area A1. If MS1 is located in area A1, then the output signal 35 will control multiplexer 37 such that the barred calls input of multiplexer 37 is coupled to the output of multiplexer 37. In this example, the barred calls input of multiplexer 37 would be the barred calls definition represented by Calls1 in column 29 of the database 23 in FIGURE 2. If MS1 is not located in area A1, then signal 35 will couple the Null input of multiplexer 37 to the output of multiplexer 37. The Null input indicates that no ODB is to be implemented. The output of multiplexer 37 is provided to VLR (see FIGURE 1) as part the MAP "Insert Subscriber Data" message sent over MAP link 12.

FIGURE 4 illustrates example portions of MSC/VLR in the VPLMN of FIGURE 1. When at 40 the MSC receives a call for MS_H that is to be forwarded (or receives from MS_H a call to be deflected), the call to be forwarded is input to a categorizer 43, which examines and categorizes the call that is to be forwarded. Then, a determiner 45 receives from categorizer 43 a signal 46 indicative of the category of the call. The determiner also receives from VLR an input 41 indicative of any forwarding calls which are barred and thus will not be forwarded from the mobile subscriber unit MS_H. If the determiner 45 determines that the call category as output from categorizer 43 corresponds to the information from VLR regarding the category of calls to be barred, then the output signal 47 from determiner 45 maintains switch 49 in the open position, so that the call is not forwarded to the destination (e.g. 15 of FIGURE 1). However, if the determiner 45 determines that the category of the call to be forwarded does not fall within the barred call category information received from VLR, then the output 47 of determiner 45 closes switch 49 to permit the call to be forwarded from the MSC to the destination 15 via the communication path 17 of FIGURE 1.

-7-

For example, if the output 46 of categorizer 43 indicates that the call at 40 is an international forwarding call directed to the mobile subscriber's HPLMN country, and if the barred call category information 41 from VLR indicates that all international forwarding calls except those directed to the mobile subscriber's HPLMN country are to be barred, then the determiner 45 will close the switch 49 to permit forwarding of the call. On the other hand, using the same call to be forwarded and thus the same output 46 from the categorizer 43, but assuming that the information 41 from VLR indicates that all international forwarding calls are barred, then the determiner 43 will maintain the switch 49 open to prevent the call from being forwarded. Information about the HPLMN and HPLMN country of MS_H is provided by VLR to categorizer 43 at input 44. VLR receives the HPLMN and HPLMN country information from HLR in the MAP "Insert Subscriber Data" message.

FIGURE 5 illustrates an example of the ODB control operations implemented by the example HLR portion of FIGURE 3. In FIGURE 5, it is first determined at 51 whether a MAP "Location Update" message has been received from an MSC/VLR, for example in the VPLMN of FIGURE 1. If so, it is then determined at 53 whether or not the mobile subscriber associated with the Location Update message has subscribed to an ODB. If not, then the database 23 of FIGURE 2 will yield a null value to be applied to the bar area input of detector 33 in FIGURE 3. (For example, if the mobile subscriber has not subscribed to an ODB, then that mobile subscriber would not have a corresponding entry in the database 23, resulting in the null input to detector 33). This null value at the bar area input of detector 33 will cause the detector output 35 to select the null value at multiplexer 37, which step is illustrated at 55 in FIGURE 5. Thereafter, at 57 the HLR sends a MAP Insert Subscriber Data message to the MSC/VLR via the MAP signaling link of FIGURE 1. Information from this Insert Subscriber Data message, including the null value from multiplexer 37, will be stored in the VLR, and the null value will be provided at 41 to the determiner 45 (see FIGURE 4). This null value indicates to the determiner that no ODBs are in effect for the mobile subscriber, so that all calls can be forwarded (or deflected) through the switch 49, regardless of the output 46 from the categorizer.

If at 53 the HLR determines that the mobile subscriber does subscribe to an ODB, then at 59 the detector 33 of FIGURE 3 determines whether or not the mobile

-8-

subscriber is located in an effective bar area. The MS location input to the detector 33 is of course received in the MAP "Location Update" message (see 51). If at 59 the detector 33 determines that the mobile subscriber is not located in the bar area, then the null value is selected at 55 to be output from the multiplexer 37 of FIGURE 3, as described above. If at 59 the detector 33 determines that the mobile subscriber is located in the associated bar area, then at 58 the control signal 35 of FIGURE 3 causes the multiplexer 37 to select the barred calls information. Thereafter, the Insert Subscriber Data message is sent over the MAP link (see FIGURE 1), and the barred calls information is stored in the VLR of the VPLMN.

In FIGURE 5 if no "Location Update" message is received at 51, it is determined at 52 whether an ODB subscription request has been received. Such a subscription request is typically done by the operator using the conventional operation and maintenance system. If so, then the ODB subscription is activated at 54, for example, by inserting into the database 23 of FIGURE 2 an entry identifying the mobile station, the bar area and the barred calls. Thereafter, the same steps (53, 55, 57, 58 and 59) are executed as described above with respect to the receipt of a "Location Update" message at 51. Thus, when a mobile subscriber that already subscribes to call forwarding (or deflecting) requests an ODB subscription at 52, if that mobile subscriber is in the bar area corresponding to the ODB being subscribed to (see 59), then the barred calls information from the database of FIGURE 2 will be transmitted in an Insert Subscriber Data message to the MSC/VLR currently visited by that mobile subscriber (see 57 and 58).

FIGURE 8 illustrates another example portion 81 of the HLR of FIGURE 1 according to another embodiment of the invention. The portion 81 implements the ODB functionality of the present invention without requiring any modifications to the conventional MSC/VLR design. Because the mobile station's call forwarding subscription is conventionally recorded in HLR, the forwarding destination number is already conventionally stored in HLR. Thus, the determiner 83 of FIGURE 8 examines the mobile station location information (from the "Location Update" request), the bar area information (from FIGURE 2), the barred calls information (from FIGURE 2), and the known forwarding destination information, and determines therefrom whether the mobile station is in a barred area and whether a forwarding call

-9-

to the forwarding destination falls in the barred calls category. The determiner output 85 then selects at multiplexer 87 either a null message or a bar message to be sent to MSC/VLR in the "Insert Subscriber Data" message. Information about whether or not to inhibit call forwarding is conventionally included in the "Insert Subscriber Data" message, for example, the so-called active quiescent state in GSM, so the ODB of the invention can be implemented by suitably communicating the conventional active-quiescent state to a conventional MSC/VLR design.

The example portion 81 of HLR illustrated in FIGURE 8 can alternatively be used to approve or deny a request to activate call forwarding services for a mobile subscriber that already subscribes to the ODB services of the invention. For example, if the HLR of FIGURE 1 receives a request (see CF request in FIGURE 8) from a mobile station (that already subscribes to the ODB service) to activate call forwarding services for that mobile station, then determiner 83 will determine whether or not the mobile station, for example MS1 of FIGURE 2, is in its associated bar area, in this example, area A1, and whether or not the barred calls category, in this example Calls1, includes a call to the forwarding destination. If the mobile station is in area A1 (the location of the mobile station is known from the most recent Location Update Message) and the Calls1 category includes calls to the forwarding destination, then the determiner output 85 will control multiplexer 89 (via the broken lines shown in FIGURE 8) such that the deny CF input of multiplexer 89 is coupled to the output thereof. Thus, the HLR determines that call forwarding should not be activated for a mobile station which is currently located in an effective bar area according to its own ODB subscription, and whose selected forwarding destination falls within the effective barred calls category of its own ODB subscription. On the other hand, if the determiner 83 does not detect that mobile station MS1 is in area A1, or does not determine that a call to the forwarding destination falls in the Calls1 category, the determiner output 85 controls multiplexer 89 such that the activate call forwarding (ACT.CF) input of multiplexer 89 is coupled to the output thereof. In this manner, the HLR makes the decision of whether or not to activate call forwarding services for the particular mobile subscriber.

FIGURE 9 illustrates example operations of the HLR portion 81 of FIGURE 8. FIGURE 9 is the same as the example of FIGURE 5 up to decision block 59. At

-10-

block 59, if the MS is in the bar area, it is then determined at 56 whether a call to the forwarding destination is in the barred calls category. If so, then the bar message is selected at 50 (see 87 in FIGURE 8), and, if not, then the null message is selected at 55 (see 87 in FIGURE 8). After the message is selected at 50 or 55, the message is sent at 57 as in FIGURE 5.

FIGURE 6 illustrates an example of the operation of the HLR portion of FIGURE 8 to control activation of call forwarding (or deflecting) services. At 61, once a request to activate call forwarding is received, it is next determined at 63 whether the requesting mobile subscriber currently subscribes to an ODB. If not, the call forwarding services are activated conventionally at 65, after which the next request to activate call forwarding is awaited at 61. If it is determined at 63 that the requesting mobile subscriber does subscribe to an ODB, it is then determined at 67 whether or not the mobile subscriber is in the bar area associated with the ODB subscription. If not, then the call forwarding services are activated at 65 as above (see 89 of FIGURE 8). If the requesting mobile subscriber is in the bar area associated with its own ODB subscription, it is then determined at 62 whether a call to the forwarding destination falls in the barred calls category. If so, then activation of call forwarding services is denied at 69 (see 89 of FIGURE 8). If a call to the destination number does not represent a barred call at 62, then call forwarding is activated at 65. Thereafter, the next request for activation of call forwarding is awaited at 61.

FIGURE 7 illustrates an example of call forwarding (or deflecting) control operations performed by the MSC/VLR portion shown in FIGURE 4. It is first determined at 71 whether the MSC has received a call to be forwarded. If so, then at 73 the categorizer of FIGURE 4 categorizes the call, and at 75 the determiner of FIGURE 4 determines whether or not call forwarding is barred for that particular call. If call forwarding is barred, then the call forwarding is denied at 77 by leaving the switch of FIGURE 4 in the open position. If call forwarding is not barred at 75, then at 79 call forwarding is enabled by closing the switch of FIGURE 4. During call forwarding operation, the switch 49 of FIGURE 4 remains closed until the forwarded call has been completed, whereupon the switch is reopened and remains so until call forwarding is next enabled. This control of the switch prevents any calls from being forwarded until it is adequately determined that no ODB is applicable to the candidate

-11-

for forwarding. After the decision to enable or deny call forwarding has been made and the appropriate action taken at 75, 77, and 79, the next candidate for call forwarding is awaited at 71.

5 By using the location of the mobile subscriber as a trigger to bar call forwarding (or deflecting) without barring all outgoing calls, call forwarding costs for roaming subscribers can be controlled, and fraud can be avoided, without restricting all outgoing calls, or all international calls, and without unconditionally barring call forwarding. The location-triggered ODB can be advantageously implemented by suitably modifying one or more of the conventional HLR, VLR and MSC nodes as
10 needed and, further advantageously, the conventional MAP signaling protocol can be used.

It will be clear to workers in the art that the embodiments of FIGURES 1-9 can be readily implemented, for example, in hardware, or software, or suitable combinations of hardware and software in a conventional HLR, a conventional MSC,
15 and a conventional VLR.

Although exemplary embodiments of the present invention have been described above in detail, this does not limit the scope of the invention, which can be practiced in a variety of embodiments.

-12-

WHAT IS CLAIMED IS:

1. An apparatus for controlling call forwarding service provided to a wireless mobile communication station, comprising:

an input for receiving information indicative of a location of the wireless mobile communication station and for receiving information indicative of a call forwarding bar area; and

a determiner coupled to said input, said determiner having an output responsive to said location information and said call forwarding bar area information for indicating that call forwarding from the wireless mobile communication station is barred, without indicating that other outgoing calls from the wireless mobile communication station are barred.

2. The apparatus of Claim 1, wherein said call forwarding bar area is located outside of a coverage area associated with a home mobile communication network of the wireless mobile communication station.

3. The apparatus of Claim 1, wherein said call forwarding bar area is located outside of a country in which is located a coverage area associated with a home mobile communication network of the wireless mobile communication station.

4. The apparatus of Claim 1, wherein said call forwarding bar area is located outside of a zone in which is included a coverage area associated with a home mobile communication network of the wireless mobile communication station.

5. The apparatus of Claim 1, wherein said input is further for receiving call identification information that identifies forwarding calls to be barred, and wherein said output is further responsive to said call identification information for indicating that call forwarding from the wireless mobile communication station is barred.

-13-

6. The apparatus of Claim 5, including a memory coupled to said input and having stored therein an entry that includes said call forwarding bar area information.

5 7. The apparatus of Claim 6, wherein said entry includes station identification information that identifies the wireless mobile communication station.

8. The apparatus of Claim 7, wherein said entry includes said call identification information.

10 9. The apparatus of Claim 5, including a memory coupled to said input and having stored therein an entry which includes said call identification information.

15 10. The apparatus of Claim 9, wherein said entry indicates that all forwarding calls are to be barred.

11. The apparatus of Claim 9, wherein said entry indicates that all international forwarding calls are to be barred.

20 12. The apparatus of Claim 9, wherein said entry indicates that all inter-zone forwarding calls are to be barred.

13. An apparatus for controlling call forwarding service provided to a wireless mobile communication station, comprising:

25 an input for receiving information indicative of a location of the wireless mobile communication station; and

an output for indicating, based on the location information, that call forwarding from the wireless mobile communication station is barred, without indicating that other outgoing calls from the wireless mobile communication station are barred.

30

-14-

14. A method of controlling call forwarding service provided to a wireless mobile communication station, comprising:

receiving information indicative of a location of the wireless mobile communication station;

5 receiving information indicative of a call forwarding bar area; and
indicating, based on the location information and the call forwarding bar area information, that call forwarding from the wireless mobile communication station is barred, without indicating that other outgoing calls from the wireless mobile communication station are barred.

10

15. The method of Claim 14, wherein said call forwarding bar area is located outside of a coverage area associated with a home mobile communication network of the wireless mobile communication station.

15 16. The method of Claim 14, wherein the call forwarding bar area is located outside of a country in which is located a coverage area associated with a home mobile communication network of the wireless mobile communication station.

20 17. The method of Claim 14, wherein the call forwarding bar area is located outside of a zone in which is included a coverage area associated with a home mobile communication network of the wireless mobile communication station.

25 18. The method of Claim 14, wherein said indicating step includes determining from the location information and the call forwarding bar area information whether the wireless mobile communication station is located in the call forwarding bar area.

30 19. The method of Claim 18, wherein said indicating step includes indicating that call forwarding is barred when (1) the wireless mobile communication station is determined to be located in the call forwarding bar area and (2) a call forwarding destination associated with the mobile station requires a forwarding call

-15-

that is included in a predetermined category of calls barred to the mobile station while the mobile station is in the call forwarding bar area.

5 20. The method of Claim 14, including identifying forwarding calls which are to be barred.

 21. The method of Claim 20, wherein said identifying step includes indicating that all forwarding calls are to be barred.

10 22. The method of Claim 20, wherein said identifying step includes identifying all international forwarding calls to be barred.

 23. The method of Claim 20, wherein said identifying step includes identifying all inter-zone forwarding calls to be barred.

15 24. A method of controlling call deflecting service provided to a wireless mobile communication station, comprising:

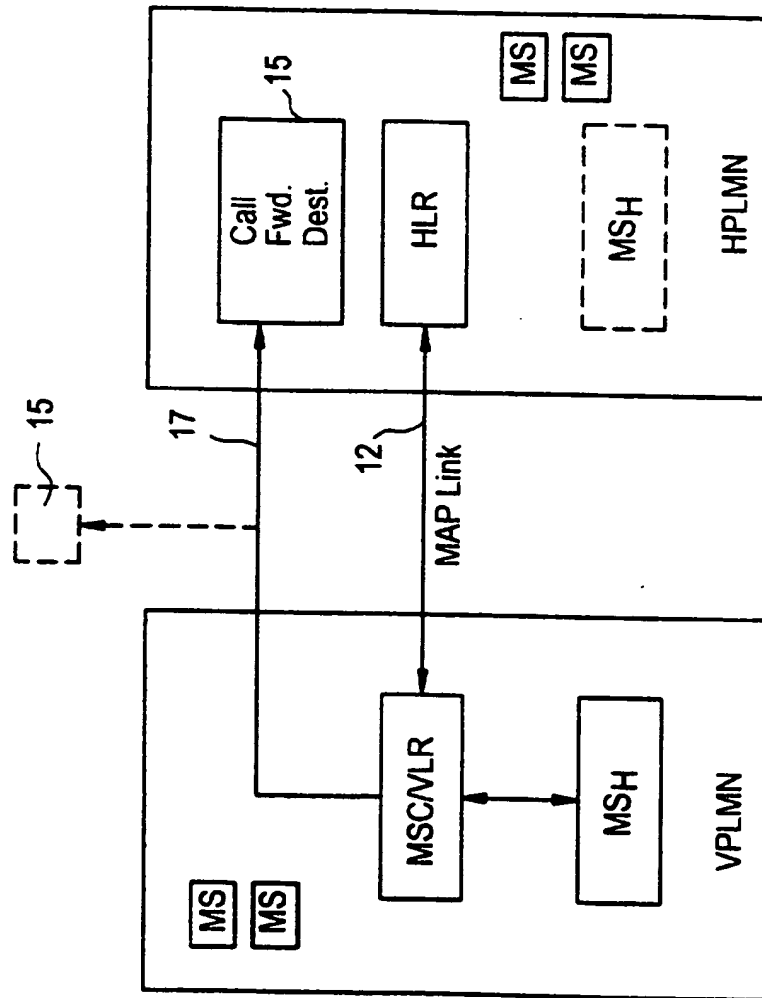
 receiving information indicative of a location of the wireless mobile communication station;

20 receiving information indicative of a call deflecting bar area; and
 indicating, based on the location information and the call deflecting bar area information, that call deflecting from the wireless mobile communication station is barred, without indicating that other outgoing calls from the wireless mobile communication station are barred.

25

1 / 6

FIG.1



2 / 6
FIG.2

25 Mobile station	27 Area	29 Barred calls
MS 1 MS 2 ⋮ ⋮	A1 A2 ⋮ ⋮	Calls 1 Calls 2 ⋮ ⋮

21 ↗ 23 ↗

FIG.3

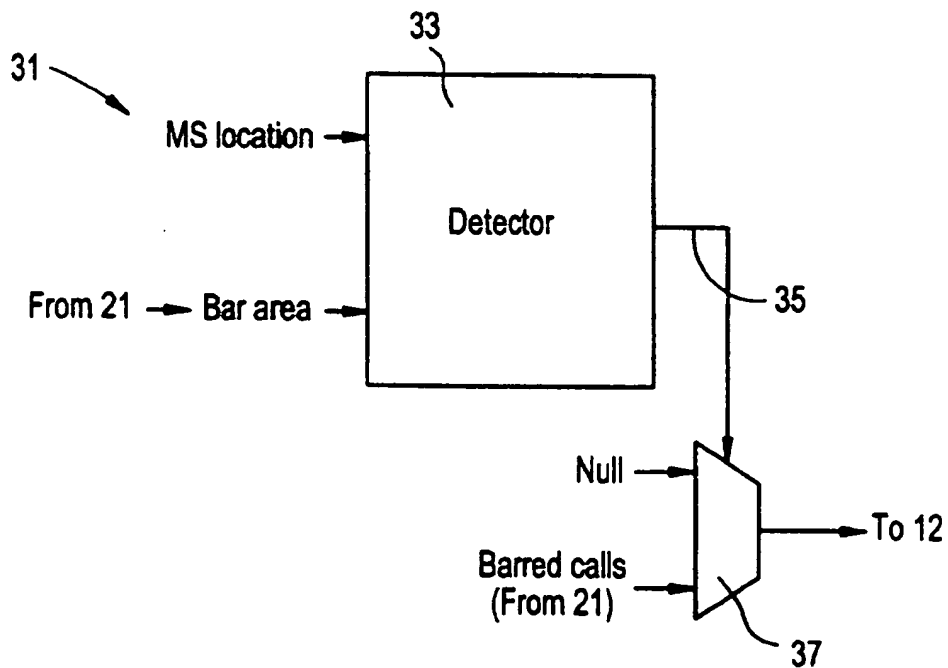
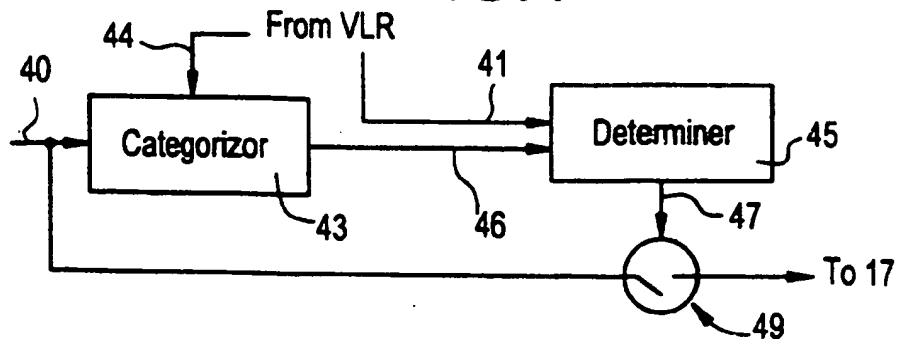
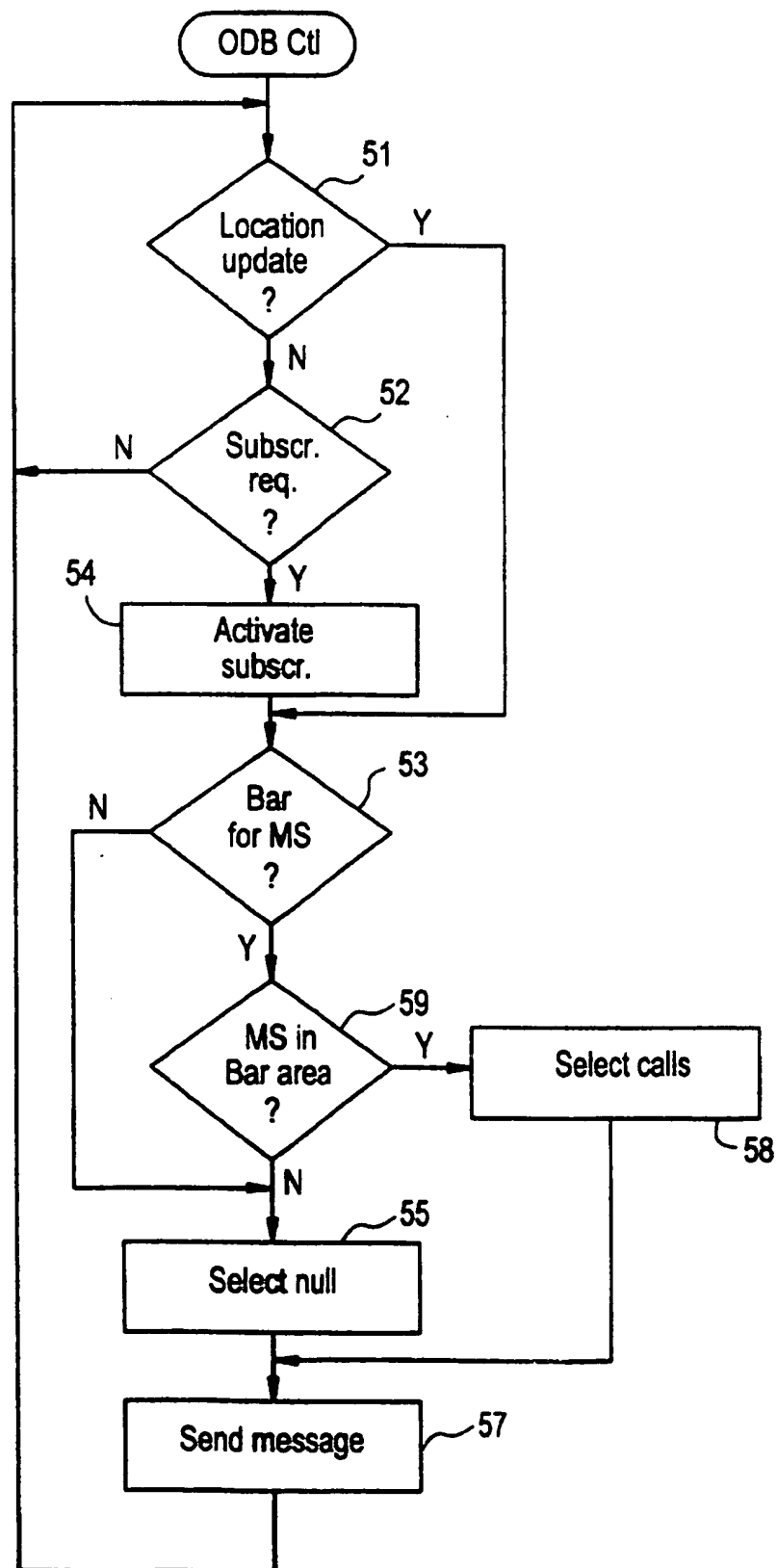


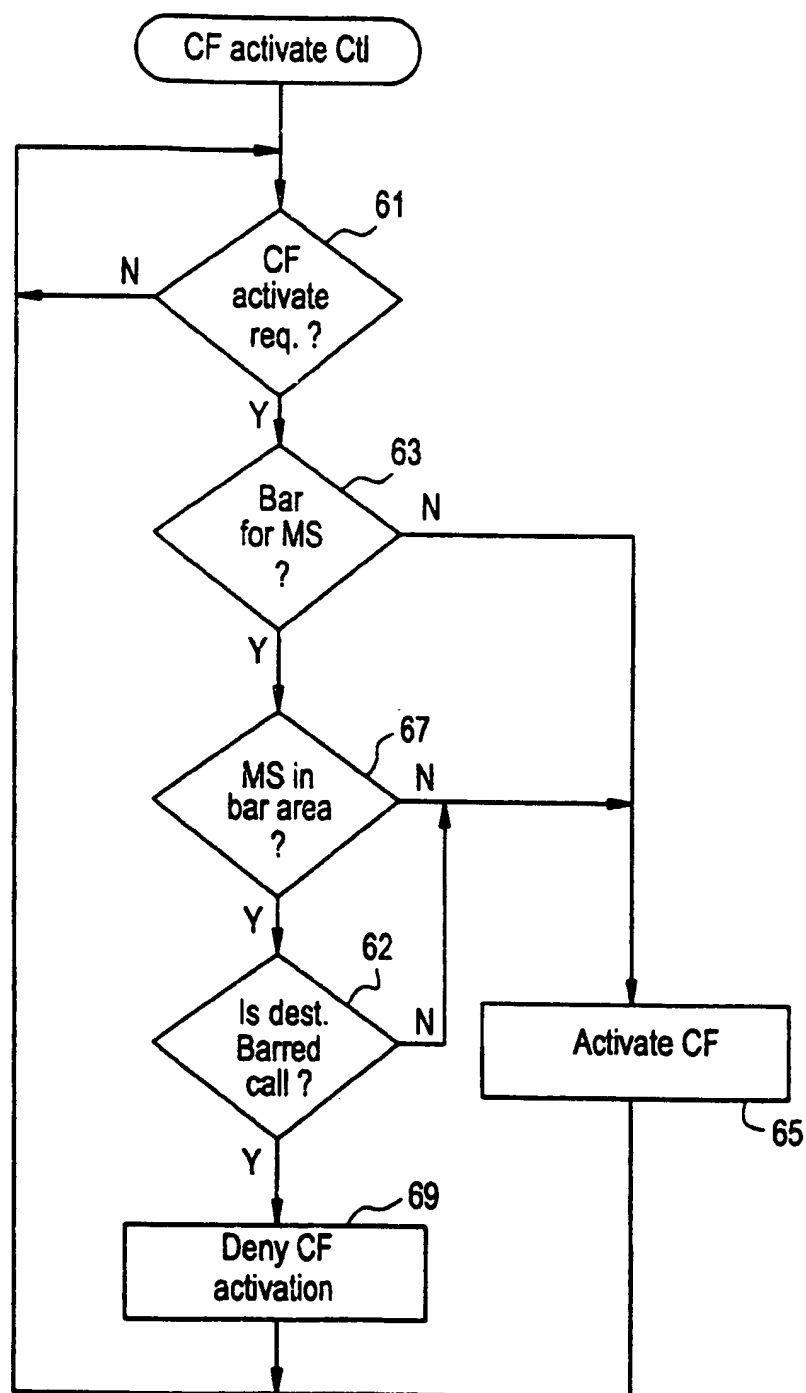
FIG.4



3 / 6
FIG.5

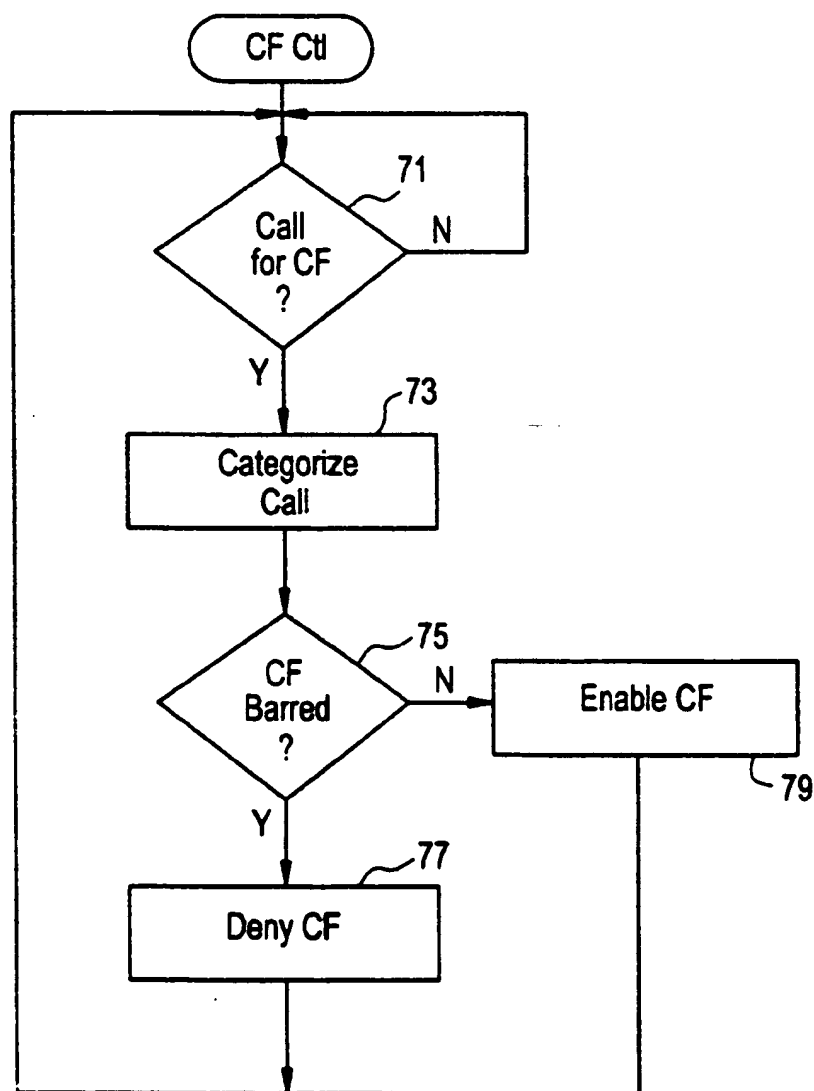
4 / 6

FIG.6



5 / 6

FIG.7



6 / 6
FIG.8

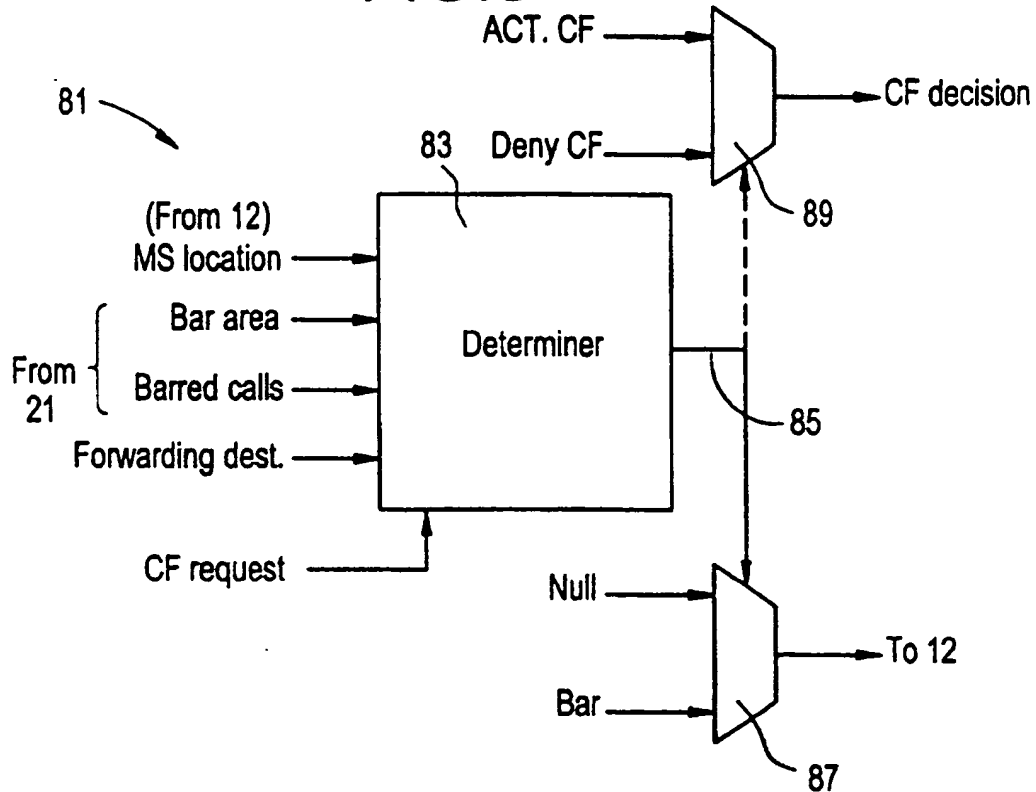
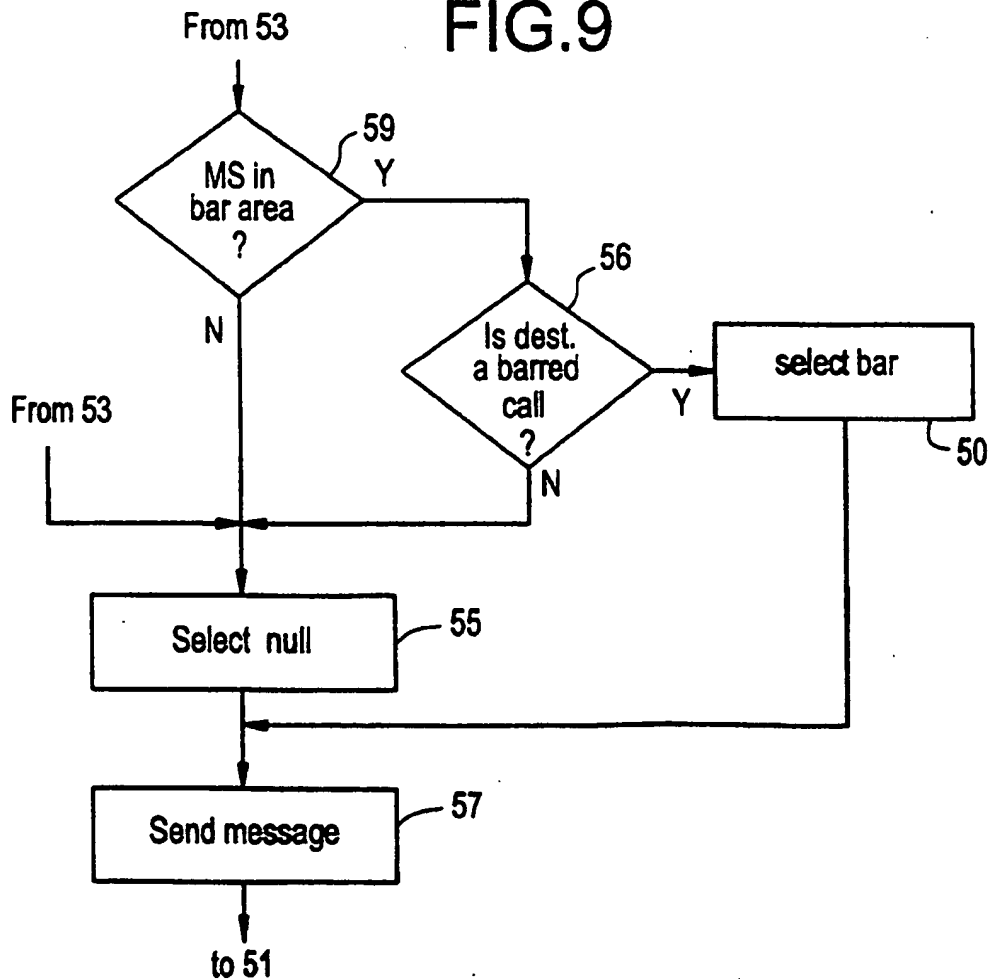


FIG.9



INTERNATIONAL SEARCH REPORT

International Application No

PCT/SE 99/01127

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 H04Q7/22 H04Q7/38 H04M3/54

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H04Q H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98 26620 A (ERICSSON GE MOBILE INC) 18 June 1998 (1998-06-18)	1-4, 13-18, 20-24
A	page 12, line 14 -page 15, line 4	5, 19
A	WO 96 34502 A (NORTHERN TELECOM LTD ; SHARP IAIN (GB); HO STEPHANIE (US); UTAS GRE) 31 October 1996 (1996-10-31) claims	1-24
A	WO 96 29839 A (TELIA AB) 26 September 1996 (1996-09-26) page 6, line 30 -page 9, line 23	1-24
A	WO 97 47152 A (ERICSSON TELEFON AB L M) 11 December 1997 (1997-12-11) the whole document	1-24

☐ Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"A" document member of the same patent family

Date of the actual completion of the international search

30 September 1999

Date of mailing of the international search report

08/10/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5618 Patentaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 apo nl.
Fax: (+31-70) 340-3016

Authorized officer

Roberti, V

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/SE 99/01127

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9826620 A	18-06-1998	AU 5699398 A EP 0945033 A	03-07-1998 29-09-1999
WO 9634502 A	31-10-1996	EP 0812518 A GB 2300334 A, B	17-12-1997 30-10-1996
WO 9629839 A	26-09-1996	EP 0872142 A NO 974298 A SE 9501048 A	21-10-1998 23-09-1997 24-09-1996
WO 9747152 A	11-12-1997	US 5903831 A AU 3198197 A DE 19781806 T GB 2330730 A	11-05-1999 05-01-1998 05-08-1999 28-04-1999